

PHRM 836
Biochemistry for Pharmaceutical Sciences II
Fall Semester 2016

GENERAL INFORMATION AND POLICIES

Last revised: November 4, 2016

Course Instructors: Prof. C. Ashendel is the course coordinator and will teach beginning in September. Prof. C. Post will be teaching the first part of the semester.

Teaching Assistant: Sijie Wang

Course requirements: The grade for this course is based only on points earned on examinations and quizzes. There is no homework though one or more quizzes may be “take home.” Additional detailed are provided below.

Learning objectives: The overall objectives of this course are to increase students’ biochemical understanding and knowledge beyond a basic level and to increase students’ ability to apply basic and advanced understanding and knowledge of biochemistry to clinically relevant situations (physiology, pathology, genetics, and pharmacology). This application of biochemistry is a process that requires a well-developed ability to think and reason in a biochemical manner, and this in turn requires, but is in addition to, a deep understanding of biochemistry. In the context of the Professional Program Outcomes, PHRM 836 primarily and directly addresses Conceptual Competence and Scientific Comprehension, specifically in regards to Biochemistry and its applications. However, PHRM 836 also requires that students practice and improve their Critical Thinking and Decision-Making skills when demonstrating their learning of biochemistry on assessments in PHRM 836.

PHRM 836 covers many advanced and clinically related aspects of biochemistry, going well beyond what should have been learned in the prerequisite one-semester basic course in biochemistry. Achieving these overall objectives requires the students in this course to learn **and understand** the facts, concepts, and formulaic processes, **and to become skilled at applying that knowledge**. On the course web site, a list is provided of specific learning objectives for each topic that is scheduled to be covered. For each topic, the learning objective list is grouped by type of learning (Facts, Formulaic Processes, and Concepts). Exams and quizzes are based on the learning objectives, but always assess both mastery of knowledge and its application.

Prerequisite information: Organic Chemistry, Physiology and Anatomy, Cellular Biology, and a one semester (standard, basic) course in Biochemistry. Ideally students should have taken MCMP 208 as the prerequisite course. Distance learning courses generally are NOT acceptable for meeting the biochemistry prerequisite.

Required Textbook: The textbook required for this course is *Textbook of Biochemistry, with Clinical Correlations*, Seventh Edition, Thomas M. Devlin, Ed., Wiley-Liss, Inc., New York, NY, 2010.

Assigned text readings: There is REQUIRED reading for EVERY topic covered. These include textbook sections and other resources that are made available on-line. A general list of textbook chapters covered in this course is shown on the final page of this syllabus (“Subjects Covered by Unit.”)

Course web site: The web site for this course can be found at <http://claserve.mcmp.purdue.edu/PHRM836/>

Course web site login and password: Students must log in to gain access to some areas of the course web site. This will use each student’s Purdue alias as the user ID, but all students enrolled in PHRM 836 must create a new password. The PHRM 836 password must be used to gain access to some parts of the PHRM 836 web site, including scores, practice quizzes, and lecture slides. To create your password for PHRM 836, you must first

request an authorization code that will be sent on request to the student's Purdue email address along with a link for using that authorization code to create a password for PHRM 836. A small web form is provided on the course web site home page to request your authorization code. The authorization code may only be used one time to set or change your password. If you forget your password, if you feel that your current password has been compromised, or if you wish to change your password for any reason, you may use the same procedure to have a new authorization code emailed to you which allows you to change your password.

Lecture attendance and courtesy: Attendance of lectures is highly encouraged but is not required and will not be recorded. All students are expected to respect the right of the other students to listen and learn during lecture. Audible conversations, cell phone ringing noise, other noises from personal electronics, arriving late, and leaving early are extremely inconsiderate. Students exhibiting such behavior will be asked to leave.

Lecture recordings and slide archives: Lectures will be recorded and digital audio encodings will be available. They will be available on the Echo 360 website in a screen+audio format (vodcast). The specific information for accessing these recordings will be indicated on the PHRM 836 course web site. Archives of slides presented in lecture (in various formats) also are provided on the course website. **Under no circumstances will any student be given a private lecture by the instructor.** Students desiring to hear a partial or complete lecture again should listen to one of these recordings.

Lecture questions and comments: Questions and corrections are always welcome during lectures. Another opportunity to ask the instructor questions is immediately before and after each lecture, though there is usually only a little time available then. However, please be aware that there is an active microphone on the podium at the front of the classroom. Since this microphone is always on, questions and comments to the instructor at the podium immediately before or after lecture may be picked up by that microphone and could be available to others in the class via the lecture recordings. Students are cautioned against revealing any confidential information when engaged in a conversation with the instructor near the podium. Questions of a confidential nature should be discussed with the instructor or a teaching assistant during a private meeting at some other – more private – location, such as outside the building or at an office meeting set up by making an appointment.

Lecture slides: The instructors will post their lecture slides to the course web site soon after each lecture. They will be in a format suitable for viewing on the web, as well as for printing. As a courtesy to the students, the instructors also will try to post a draft version of his/her lecture slides in advance of each lecture. Due to unforeseen scheduling and coordination problems, this is not guaranteed and the draft versions of slides may not be available before every lecture. Though every effort will be made to prevent errors in slides posted prior to lecture, any errors found in the draft slides will be corrected when a final version is posted after lecture to the “slide archives” on the course website. The slides posted after lecture will remain available throughout the semester, while the draft version of slides posted before lecture will be removed from the web site after each lecture. The slides posted to the web will contain copyrighted figures, and so access to slides will be restricted to enrollees by requiring students to log in with their career account/myPurdue login user ID and a special password for use only in PHRM 836 (see “Course web site login and password” section above.)

Office hours: The instructors will maintain regular weekly office hours during the hour after each time she or he lectures. Dr. Ashendel also will hold office hours after each of the first two exams. All office hour information will be posted on the course web site. Additional consultations with the instructors may be arranged via appointment. The office hours and locations of the teaching assistants will be announced. Students should contact the instructors or TA to schedule meeting times if they cannot make the scheduled office hours.

Email to instructors and TA: Students are encouraged to send comments, corrections, and questions to the instructors and/or TAs via email. The instructors' and TA's email addresses are posted as links on the course web page. In addition to regular email, an anonymous mailer web application allows for students to send email

anonymously to either of the course instructors. It is provided for students who wish to make comments to the instructor but who do not want to be identified. A link to the web form for this application and instructions on its use are on the course web site. **It is not possible for the instructors to respond directly to the sender of anonymous email.** However, when it may benefit the entire class, a response to questions emailed anonymously will be sent to the entire class.

Email announcements: From time to time the instructors may make announcements pertaining to the course via email. All students officially enrolled in the course will receive such emails via their Purdue email account. It is the responsibility of students to check their email account on a daily basis or more frequently in order to receive these announcements in a timely manner. In certain cases, answers to questions emailed to the instructor will be made anonymous and emailed to the entire class so everyone can benefit from the answer.

Help sessions: There will be one instructor help session and one TA help session during the 1 to 3 day period before each exam. Also, a TA help session is scheduled on the day before each quiz. A general review of large amounts of material will not be possible. Attendance at help sessions is voluntary and no new material will be presented. The times and places of all help sessions (except for the final exam) are listed elsewhere in this syllabus as well as posted on the course web site. Help sessions for exams also will be announced in lecture before the exam. The help sessions for exam 3 will be announced after they are scheduled.

Student ID numbers: To protect the identities of students, **identifying numbers of any kind are NEVER USED** in this course. Please **do NOT write any student ID number on any document used in this course** including exams, answer sheets, or emails. Students in this course will use **ONLY THEIR NAME** for identification.

Course grade: The course grade for each student is based solely on the total points earned as follows:

Exams, Quizzes:	Points each	Total Points
First 2 exams	75	150
Exam III	150	150
Quizzes (best 5 of 7)	12	60
Maximum possible points		360

The course grade for each student either is based on a "straight scale" or is based on a "modified straight scale" that depends on the class average. **The modified straight scale is used ONLY if the class average is less than 75%.** The actual course grade cutoffs used for grades may be **lower** than those indicated below (resulting in higher grades for some students.) The grade cutoffs actually used will not be disclosed.

Course grade	Straight Scale Points	Modified Straight Scale Points ("Avg" = total points class average as % of 360)
"A+"	>91%	$\geq \text{Avg} + 16\%$
"A"	>85% and $\leq 91\%$	$> \text{Avg} + 10\%$ and $\leq \text{Avg} + 16\%$
"A-"	>80% and $\leq 85\%$	$> \text{Avg} + 5\%$ and $\leq \text{Avg} + 10\%$
"B+"	>77% and $\leq 80\%$	$> \text{Avg} + 2\%$ and $\leq \text{Avg} + 5\%$
"B"	>73% and $\leq 77\%$	$> \text{Avg} - 2$ and $\leq \text{Avg} + 2\%$
"B-"	>70% and $\leq 73\%$	$> \text{Avg} - 5$ and $\leq \text{Avg} - 2$
"C+"	>67% and $\leq 70\%$	$> \text{Avg} - 8\%$ and $\leq \text{Avg} - 5\%$
"C"	>63% and $\leq 67\%$	$> \text{Avg} - 12\%$ and $\leq \text{Avg} - 8\%$
"C-"	>60% and $\leq 63\%$	$> \text{Avg} - 15\%$ and $\leq \text{Avg} - 12\%$
"F"	$\leq 60\%$	$< \text{Avg} - 15\%$

A grade of "Incomplete" will not be given in this course.

The class average used to trigger and set the modified straight scale grade cutoffs will be calculated without including any extra credit. Each student's grade calculation, however, will be done with point totals that include extra credit. However, point ranges (cutoffs) for each grade will be calculated from percentages based on 100% = 360 points.

Questions about grading policy and grades should be directed to the instructor in charge of the course. Students are encouraged to seek assistance of their academic adviser and the instructor in charge of the course in rare cases involving lifetime emergencies (e.g., you are in a major incapacitating accident or you have a life-threatening illness involving extended hospital stays) that cause significant but unavoidable absences from lecture.

Academic dishonesty policy The first incident of academic dishonesty will result in the assignment of an 'F' grade for the course and expulsion from the course. Academic dishonesty includes but is not limited to the following: copying from other students' quizzes or exams; using notes, books, handouts, information stored in any electronic device (programmable calculators, cell phones, computers, etc.) during in-class quizzes or during examinations; requesting reevaluation (re-grading) of any work that has been altered after it was graded; and representing anyone else's work as your own.

If any take-home quizzes are assigned, students may work on them in groups. However the answers to take-home quizzes submitted for grading must be written individually by each student. The submission of photocopied or hand-copied answers is considered academic dishonesty. Since the basis for determining this is the distinctiveness of your answers, it is each student's responsibility to make sure that they submit answers that are distinctly their own. If you wish to quote the text (or the author of any publication, even a web site) you must indicate the author and source of the quoted passage. Using the work of others (even just the ideas or a single short phrase) but failing to attribute authorship of that work to its author constitutes plagiarism, and this is academically dishonest.

Exams: There are three exams held during the semester. Each exam covers the material presented since the previous exam. The last exam is held during final exam week but is not cumulative. Students will be given a maximum of 60 minutes to complete each of the first two exams which are held in the evening and 120 minutes to complete the third exam, which will be held during final exam week. One lecture is canceled for each evening exam. The University administration schedules the exam held during final exam week and the time and location will be announced with that information is available around the middle of the semester. Please be aware that the University may schedule the last exam as late as SATURDAY of final exam week (yes, there are Final exams scheduled for Saturday.)

Approximately 30% to 40% of the points on each exam will require drawing a structure or diagram, writing an essay or short answer, or completing a table. The answers to such problems are written on the exam. The remaining 60 to 70% of the points on each exam will be for computer-graded problems (usually 3 points each; multiple choice and matching) and the answers for these are indicated on Scantrons. It is the responsibility of each student to accurately and completely complete the Scantron prior to turning it in with the exam, and no changes will be allowed to a Scantron or exam after it has been turned in. The exams problems are written based on the stated learning objectives for the topics covered by the exam.

Exams and quizzes are not "open book" and the textbook or notes of any kind may NOT be used during exams or quizzes. No calculation problems involving other than very simple arithmetic will be on the exams or quizzes. The use of electronic devices of any kind – including calculators, computers, cell phones, PDAs, digital recorders or music players, or communication-enabled devices of any kind (i.e., watches) - is not allowed during exams and quizzes. To prevent even the appearance of using such prohibited electronic devices, all electronic devices should be left at home or kept stored inside backpack, purses, bags, or pockets. Once an exam or quiz has been distributed,

students are not allowed to leave the room (no bathroom breaks) until they have submitted their exam or quiz for grading.

Students may be excused from an exam only (not quizzes) with a legitimate excuse such as statement of illness from a physician or health clinic. If possible, such students should contact the instructor in charge of the test (or Prof. Ashendel) **before** the exam. Teaching assistants, academic advisers, and University administrators cannot excuse you from taking an exam at the assigned time. By University policy, students with three or more exams scheduled for the same day during final exam week may request that one of them be rescheduled to an alternative day so to reduce their examination load to no more than two exams in any one day. See Prof. Ashendel if this applies to you. The policy for an excused absence from exams in PHRM 836 is that **NO make-up exams will be provided** and the excused student's course grade will be based on a calculated score for the excused exam. In such cases, the calculated score for the excused exam will be the score that does not alter the overall ranking (percentile) for that student in the class. In other words, the course grade will be based on the remainder of the students work. The excused student's performance rank in class will not be affected by the absence of a score for an excused exam.

Practice quizzes: To achieve the objective of the course, it is important that every biochemistry topic presented in lecture be understood and learned well enough to apply it by most of the students. Some biochemistry topics are more challenging to learn than others. To obtain useful information about student learning, practice quizzes will be offered on-line. These will be similar in format to regular quizzes, but may have more questions and will be administered on-line (accessed via the course web site). These will be offered immediately after the last lecture before each quiz and close before the TA help session held on the day before the quiz. Access to practice quizzes will be provided via the course web site. Practice quiz keys will be made available on-line after the practice quiz closes. Viewing the practice quiz after it closes will display the key and mark your choices. Practice quizzes generally will have one question for each major topic covered since the last exam or quiz. The results of student performance on the quiz will help the instructors determine if supplemental instruction is needed for any topic. Students may also use the results of their practice quizzes to identify areas where understanding/learning is weak. Any supplemental instruction provided by the instructors will be announced by email and may take a variety of forms from on-line explanation to a review of the topic in a specially scheduled help session. The TA running the help session for each quiz also will consider the Practice Quiz results during those help sessions. Students are strongly encouraged to take each of the practice quizzes. Obtaining useful statistics about student learning requires that sizable number of students take each practice quiz. Therefore, encouragement is provided to students to take practice quizzes in the form of a reward of **0.5 point of extra credit for each practice quiz completed**. Students must log in with their career account alias and PHRM 836 password in order to take or view each practice quiz (see the section on Course web site login above for more information about the password.) Except for the extra credit, performance on the practice quizzes or failure to take a practice quiz will not enter into the calculation of course scores and grades.

Quizzes: The goal of quizzes is to motivate students to stay current with reviewing the lecture material and text readings. Seven quizzes are scheduled to be held in class. In-class quizzes will cover the material covered since the most recent prior exam or quiz (or the start of the semester.) Quizzes usually are held in the first 10-15 minutes of class, typically consist of four questions with multiple-choice answers and are computer graded. Only quiz answer sheets ("scantrons") are turned in and the quizzes may be kept by the students. It is each student's responsibility to check their answer sheet to make sure it has been filled in properly (including administrative information such as name and quiz version number). Failure by a student to completely and accurately complete the quiz answer sheet likely will result in a lower score awarded for that quiz, which is the penalty for not following instructions. In-class quizzes are not "open book" and the text and notes of any kind may not be used. Use of any kind of calculator or electronic device also is prohibited. Some quizzes may be "take-home", in which case the due dates and other specifics will be announced in class.

For each student, his or her lowest two quiz scores will not be added into his or her semester point total. In other words, only the best five of the seven quiz scores for each student will count towards a student's course grade. Because of this allowance, there are **absolutely no make-ups for quizzes for any reason.**

Return of graded quizzes and exams: Exam 3 will not be returned to the students. The computer graded answer sheets from in-class quizzes and all exams are not returned to the students. Exams 1 and 2 will be returned to students in class with an indication of their score on them. Since exam 3 all quizzes will not be returned, students will not be informed directly of their score on it, but students may use the score look-up web application to determine their scores. Each of exams 1 and 2 and will be returned to students by being sorted by last name alphabetically, divided into four groups by section of the alphabet, and placed in stacks around the room lecture hall at the end of a lecture. Any exam not picked up in lecture will be retained and must be picked up from the at some other time. Scores for exams will not be directly visible to the other students during the process of returning these. However, all students are entitled to privacy about their scores, and any student that does not want to have their exams returned in this manner should tell the instructor or TAs in advance and for those students who request it (in advance), the returned exam may be obtained directly from the instructor.

Score query (look-up) system: Scores and score distributions for each quiz and exam, as well as subtotals, total points, extra credit points, class rank, and calculated course grade will be available via a link on the course web site. Students must log into this system using their career account/myPurdue login user ID and a password provided to them for use only with PHRM 836.

Exam keys and re-grades: The key to each exam is prepared by the professor(s) involved, and will be posted on the course web site shortly after the exam. Students with questions about the grading of the essay questions on exams 1 and 2 should see the Teaching Assistant. In other words, only the answers to the answers to the essay/short answer exam questions on Exams 1 and 2 will be considered for regrading. Students must make this request in person with the TA. Questions about potential arithmetic errors (summing of scores) also should be directed to the TA. **Time limit for requesting exam re-grades (or correcting arithmetic errors):** No take-home quizzes or exams will be accepted for re-grading more than two weeks after the date of the return of the exam to the class.

Course and instructor evaluations: To provide time for thoughtful responses and also for confidentiality, an electronic questionnaire will be used for evaluating each course instructor and the course. A single questionnaire will be used for this. It will open two weeks prior to the start of final exam week, at the end of the semester will remain open for two weeks. This will be announced in class and via class email. Dates and additional instructions will be posted on the course web site. Your responses will be anonymous and will not be linked with your name or identifying information. However, a record will be kept of who has completed each evaluation. To encourage participation in these evaluations, **4 points of extra credit** will be given for completing both evaluations. These extra credit points will be added after calculating the class average used to trigger the modified straight scale but will be added when determining the score and course grade for each student. All responses are confidential, and the responses are not provided to the instructors until after the grades for the course have been submitted to the Registrar.

Reservation to make changes: In the event of a major campus emergency involving the cancellation of class sessions, the above requirements, deadlines and grading policies may be subject to changes as required in order to deal with such an emergency situation. Any such changes in this course will be posted on the course website once the course resumes, or can be obtained by contacting the instructor via email or phone.

Instructor Help Sessions

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Event	Date	Time	Room
Exam I help session	Sunday September 18	3:30 – 4:30pm	LILY 1105
Exam II help session	Thursday October 20	12:30 – 1:20 pm	LILY G126
Exam III help session	Monday December 12	1:00 – 2:00 pm	RHPH 164

Teaching Assistant Help Sessions

Event	Date	Time	Room
Quiz 1 help session	Wednesday, August 31	8:00 to 9:00am	RHPH 162
Quiz 2 help session	Monday, September 12	8:00 to 9:00am	RHPH 162
Exam I help session	Monday, September 19	8:00 to 9:00am	RHPH 162
Quiz 3 help session	Monday, October 3	8:00 to 9:00am	RHPH 162
Quiz 4 help session	Monday, October 17	8:00 to 9:00am	RHPH 162
Exam II help session	Monday, October 24	8:00 to 9:00am	RHPH 162
Quiz 5 help session	Wednesday, November 2	8:00 to 9:00am	RHPH 162
Quiz 6 help session	Wednesday, November 16	8:00 to 9:00am	RHPH 162
Quiz 7 help session	Wednesday, November 30	8:00 to 9:00am	RHPH 162
Exam III help session	Tuesday, December 13	Noon to 1pm	RHPH 162

Lecture Schedule

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12:30 to 1:20 pm Lilly Hall of Life Sciences G126

Instructor	Date	Day	Special Event	Lecture Topic
	Aug. 23	Tues	No class: Orientation	
Post	Aug. 25	Thur		Protein structure-function relationship: recognition (immunoglobulin), catalysis (serine proteases)
Post	Aug. 30	Tues		Protein structure-function relationship: allostery (hemoglobin vs myoglobin)
Post	Sept. 1	Thur	Quiz 1	Enzyme catalysis: structural basis and energetics of transition state stabilization, substrate recognition; coenzymes
Post	Sept. 6	Tues		Regulation of enzyme activity and metabolic pathways
Post	Sept. 8	Thur		Therapeutic targeting of proteins I: enzyme inhibition and selectivity
Post	Sept. 13	Tues	Quiz 2	Therapeutic targeting of proteins II: protein applications
Post	Sept. 15	Thur		Cytochrome P450 and nitric oxide synthases
Post & Ashendel	Sept. 20	Tues	No class	
Post & Ashendel	Sept. 20	Tues	Exam I 8:00-9:00pm Lilly 1-105	
Ashendel	Sept. 22	Thur		Nucleic Acid Structure
Ashendel	Sept. 27	Tues		Nucleic Acid Structure
Post	Sept. 29	Thur		Transcription factor-DNA interactions
Post	Oct. 4	Tues	Quiz 3	Membrane transporters
Ashendel	Oct. 6	Thur		Signal transduction
	Oct. 11	Tues	No class - Fall Break	
Ashendel	Oct. 13	Thur		Signal transduction
Ashendel	Oct. 18	Tues	Quiz 4	DNA replication, repair, and recombination
Post & Ashendel	Oct. 20	Thur	No class – help session	
Post & Ashendel	Oct. 24	Mon	Exam II 6:30-7:30pm Lilly 1-105	
Ashendel	Oct. 25	Tues		Transcription and post-transcription
Ashendel	Oct. 27	Thur		Transcription and post-transcription
Ashendel	Nov. 1	Tues		Translation and Post-translation; Applications in biotechnology
Ashendel	Nov. 3	Thur	Quiz 5	Advanced Carbohydrate Metabolism: Diseases and metabolism related health issues
Ashendel	Nov. 8	Tues		Advanced Lipid metabolism I – Fatty acid and Triglycerides: absorption, distribution, and regulation of metabolism
Ashendel	Nov. 10	Thur		Advanced Lipid metabolism I – Fatty acid and Triglycerides: drugs and disorders
Ashendel	Nov. 15	Tues		Advanced Lipid metabolism II – Cholesterol: transport, metabolism, and excretion; drugs and disorders
Ashendel	Nov. 17	Thur	Quiz 6	Advanced Amino Acid metabolism: One carbon metabolism, relationship to certain vitamin deficiencies, basic clinical elements (N balance, essential amino acids and nutritional protein quality, diseases, creatine and creatinine)
Ashendel	Nov. 22	Tues		Advanced Amino Acid metabolism: Specific pathways and disorders; clinical situations and protein nutrition management
Ashendel	Nov. 24	Thur	No class – Thanksgiving Holiday	
Ashendel	Nov. 29	Tues		Heme and iron metabolism and disorders
	Dec. 1	Thur	Quiz 7	Advanced Nucleotide metabolism: Disorders and drugs
Ashendel	Dec. 6	Tues		Metabolic Interrelationships: basic macro-nutrition; BMR and activity; obesity; appetite and satiety; feed-starve cycle
Ashendel	Dec. 8	Thur		Metabolic Interrelationships: metabolic syndrome, regulatory pathways, diabetes, and drugs
Ashendel	Dec. 13	Tues	Exam III 7:00 to 9:00 pm Lilly 1-105	

Subjects Covered by Unit

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<u>Subjects</u>	<u>Text Chapters</u>	<u>Hours</u>
Advanced Protein Structure-Function	9	2
Advanced enzyme catalysis, kinetics, inhibition, regulation, and applications	10	4
Cytochrome P450 and Nitric Oxidases	11	1
Exam I		1
Nucleic Acid Structure: Stability, pitch, deformation, supercoiling, topoisomerases, compaction, melting/annealing, helicases	2	2
Protein-DNA interactions: Transcription Regulatory Factors	8.8-8.9	1
Membrane transporters	12.6-12.11	1
Signal transduction	13	2
DNA replication: Initial melting, regulation, drugs, genes	4	1
Exam II		1
Transcription and post transcription: Initial melting and regulation by DNA binding proteins in eukaryotes, DNA structure, and novel mechanism; alternative splicing; RNA interference	5 and 8	2
Translation: Ribosome structure, function, and translation inhibitors Post-translation: Protein targeting, modification, and targeted degradation	6	0.5
Advanced biotechnology	7	1
Clinically relevant aspects of carbohydrate metabolism and bioenergetics	14,15,16	0.5
Advanced Lipid metabolism I: FA and TG absorption, distribution, and regulation of metabolisms and diseases	17	2
Advanced Lipid metabolism II: Cholesterol transport, metabolism, and excretion	18	1
Advanced Amino Acid metabolism: One carbon metabolism, relation to certain vitamin deficiencies, basic clinical elements (N balance, essential AAs, diseases, creatine and creatinine)	19.1 – 19.6	2
Heme metabolism and iron	19.7 – 19.8 and 26.10	1
Nucleotide metabolism	20	1
Metabolic Interrelationships and hormonal regulation; macro-nutrition; obesity and diabetes	21 and 27	2
Exam 3 (during final exam week)		1